PROJECT REPORT

IT426: ARTIFICIAL INTELLIGENCE SYSTEMS

INTRODUCTION

In this project, we explored the efficiency of Genetic Algorithms (GA) versus Local Search Algorithms (LSA) in optimization tasks, tweaking GA parameters to determine the best approach for achieving optimal solutions.

EXPERIMENTS RESULTS

Genetic Algorithm

Population size	Crossover Operator	Mutation Operator	Best Fitness
10	Single-Point Crossover	M1	-0.167
100	Single-Point Crossover	M1	-0.17641
10	Single-Point Crossover	M5	-0.194
100	Single-Point Crossover	M5	-0.2203
10	None	M5	-0.237
10	Single-Point Crossover	None	-0.65811

Tabel1 -Genetic Algorithm results

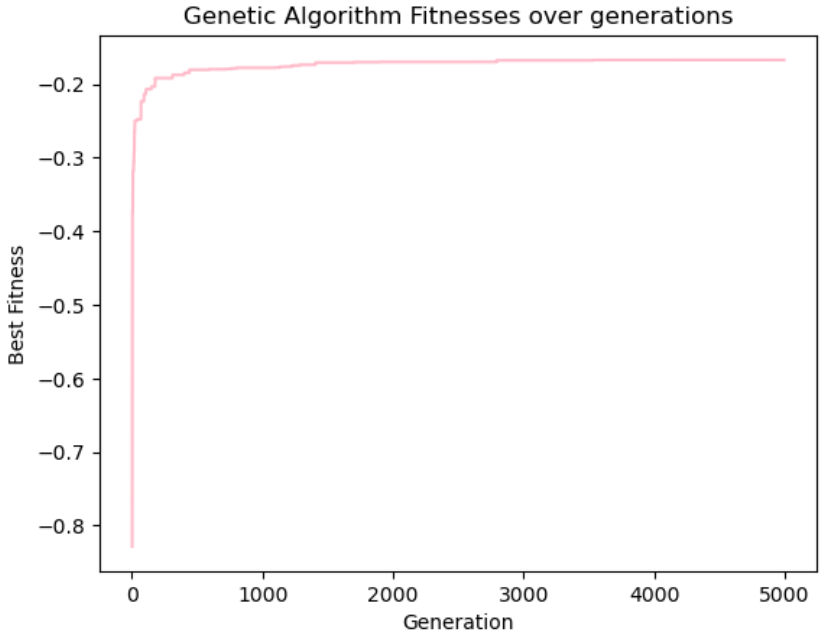

Figure1 -Genetic Algorithm Fitnesses over generations

Local Search

Experiment	Best Fitness
1	-0.9644
2	-0.9185
3	-0.9055
4	-0.8487
5	-0.88654

Tabel2 -Local Search results

RESULTS ANALYSIS

Question 1: Which combination of parameters produces the best results?

Answer: The best results were produced with a population size of 10 using single-point crossover and the mutation operator M1, which achieved a best fitness score of -0.167.

Question 2: Why do you think this is the case?

Answer: This superior performance could be due to a well-suited initial population that allowed for effective exploration and exploitation of the solution space, even with a smaller population size. The use of M1 as the mutation operator suggests that a moderate amount of mutation was sufficient to introduce beneficial diversity without disrupting the convergence process.

Question 3: What was the effect when you removed mutation? What about crossover?

Answer: When mutation was removed (in the experiment with a fitness score of -0.65811), the performance dropped significantly, indicating that mutation is critical for introducing new genetic material into the population and preventing the algorithm from getting stuck in local optima. The removal of crossover was not tested in these experiments, so its effect cannot be deduced from the given data.

Question 4: Which algorithm is better?

Answer: The genetic algorithm outperformed the local search due to its expansive search strategy. It assesses a wide array of solutions, increasing the likelihood of discovering superior solutions, unlike local search, which progresses incrementally from a single solution and may become trapped in local optima.

CONCLUSION

The study concluded that GAs, particularly with a small population size and moderate mutation, outperform LSAs in optimization problems, achieving better fitness scores due to their superior ability to explore and exploit the solution space and avoid local optima. This highlights the GAs' robustness in complex optimization scenarios.

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